ORGANIZATIONS WITH PROGRAMS BENEFICIAL TO COAL-MINE EMPLOYEES

By W. D. Walker, Jr., and S. P. Polack

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UNITED STATES DEPARTMENT OF THE INTERIOR
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FOREWORD

The increasing number of inquiries from foreign and domestic sources for information that will help to establish educational programs for coal miners has brought this subject forward.

The purpose of this publication is to show the various avenues of safety available to the coal miner and his employer as well as institutions, organizations, and agencies whose duty it becomes to teach the job "know-how" for reaching the common goal of greater safety for the largest number of coal miners.

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W. D. Walker, Jr.[1] and S. P. Polack[2]

CONTENTS

	Page
Introduction	1
Acknowledgments	1
Federal Bureau of Mines	1
Motion-picture films	2
Publications	4
Demonstrations	12
Safety-training courses	13
State mining departments	14
Programs conducted by individual mine operators	15
Programs conducted by mine workers' organizations	15
Institutes, societies, and other educational organizations	16
The Joseph A. Holmes Safety Association	16
The Holmes Safety Association	17
National Mine Rescue Assocation	17
The Mining Electro-Mechanical Maintenance Association	18
National Safety Council	18
American Mining Congress	18
American Institute of Mining and Metallurgical Engineers	18
Coal Mining Institute of America	19
Pittsburgh Coal Mining Institute	19
Mine Inspectors'Institute of America	19
National Coal Association	19
Universities, colleges, and high schools	20
Conclusions	20

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INTRODUCTION

The trend toward encouragement of worker participation in accident prevention in the coal mines of the United States is not new; however, it has been given added impetus in recent years and is now definitely progressing. It has been found by experience that, although there are many approaches to a mine-safety program that will include the workers themselves as well as their supervisors, no one way is suitable under all circumstances. It requires the concerted efforts of many agencies working along parallel lines toward a common goal.

The following seven principal agencies, using somewhat different methods, are listed to illustrate how this problem is approached throughout the coal-mining industry:

1. Federal Bureau of Mines.
2. State mining departments (in individual States where coal is produced).
3. Programs conducted by individual mine operators.
4. Programs conducted by mine workers' organizations (unions).
5. Institutes, societies, and other educational organizations.
6. Coal operators' associations (regional and national).
7. Universities, colleges, and high schools.

Each of the seven approaches to safety are discussed briefly, and their methods and contributions, such as publications and other activities, are listed.

ACKNOWLEDGMENTS

The assistance given the authors by their associates in the Federal Bureau of Mines and by personnel of the State agencies, organizations, and universities mentioned in this publication is greatly appreciated and is hereby acknowledged.

FEDERAL BUREAU OF MINES

The Bureau of Mines, United States Department of the Interior, is by far the largest single contributor in the field of coal-mine safety. Knowledge essential to safe working conditions and practices is available to the individual coal miners and operating companies from this source.

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Bureau of Mines research and investigations cover the causes, prevalence, probability, and contributory factors of virtually all types of mine accidents. This information has been extended to include safety devices and practices to reduce the number of or prevent similar types of accidents that may result in injuries, death, disaster, or widespread property damage.

Bureau of Mines safety instructors take the results of this research into mining communities and occasionally into the mines to instruct workers in principles of safety that pertain to their jobs and the jobs of their fellow miners.

Bureau of Mines publications form the basis for job-safety instruction. These publications are distributed by the instructors or may be procured from the Bureau of Mines by any individual who desires to increase his knowledge in matters pertaining to mine safety. Many such publications are distributed free.

Bureau-made motion pictures, slides, and demonstration units are provided for the instructors' use. These aids add emphasis to the published material and enable the instructors to make full use of their own experience.

The Bureau cooperates with the various State agencies and with all the other organizations mentioned herein by furnishing material and personnel to help such organizations carry out their safety programs.

Motion-Picture Films

The Bureau of Mines maintains an extensive library of motion-picture films for free loan to educational institutions, industries conducting training classes for workers, engineering and scientific societies, civic and business associations, and other responsible organizations. These films depict safety and first aid, as well as mining and metallurgical operations and related manufacturing processes, showing where minerals are found and how they are extracted from the earth, refined, or manufactured into useful products, and utilized. A series of State films deals with the natural resources of the various States. Although circulated by the Bureau of Mines, these films are sponsored and financed entirely by cooperating industrial concerns. They are free of trade marks, trade names, or other direct advertising. The main distributing center is at the Bureau of Mines Experiment Station, 4800 Forbes Street, Pittsburgh, Pa., where a complete library of all films is maintained. In addition, subdistributing centers selected with regard to accessibility circulate copies of certain films. A catalog, Motion-Picture Films of the Bureau of Mines, which may be obtained free from the Bureau, describes all the free loan films and explains in detail how to become a borrower.

The Bureau's safety-training films are not loaned but are shown by Bureau instructors and other personnel as part of the over-all educational program. However, arrangements may be made to have a Bureau representative show one or more of these pictures at any gathering promoting mine safety.

A list of safety-training films follows.

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Title	Kind of film	Projection time, minutes	Description
Holger Nielsen Method of Artificial Respiration	Sound on color	15	Administration of this method of artificial respiration.
Motorman and Brakeman (First of a Series on Haulage Safety)	do.	17	Five underground haulage accidents and how to prevent them.
Demonstrations of Coal-Mine Explosions and Fires	do.	19	Actual explosion at Experimental mine and how such explosions can be initiated and prevented; also pictures a coal-mine fire at the Experimental mine.
Schedule 22	Sound on black and white	18	Testing diesel locomotive for permissibility.
Roof Bolting in Coal Mines	do.	32	Use of roof bolts in a coal mine for greater safety. (Roof control).
Roof Bolting in Metal Mines	Sound on color	22	Use of roof bolts in metal mines.
Haulage in Anthracite Mines	Sound on black and white	29	Some causes of haulage accidents in anthracite mines.
Prevention of Accidents from Falls of Roof and Coal	do.	31	Accidents from falls of roof, stressing roof support at the faces of working places.
Safe Timbering Practices in Anthracite Mines	Sound on black and white	30	Procedure involved in erecting some anthracite timbers.
Safety Course for Coal Miners	do.	35	Safe means of mining coal, cutting, drilling, blasting, and loading mechanically.
The Coal Loader	do.	28	Safe loading of coal in hand-loading mines.
Safety in Tunneling Operations	do.	52	Drilling, blasting, and mucking in tunnel construction.
Color for Safety on Oil-Well Drilling Rigs	Sound on color	31	Using color as a means of preventing accidents on drilling rigs.
Metal Mining Safety	Sound on black and white	54	Drilling, blasting, and loading ore in metal mines.

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Publications

Some of the Bureau of Mines publications used in conjunction with safety-training programs for mine workers are listed below. Bulletins, technical papers, handbooks, and miners' circulars, printed by the Government Printing Office, may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at the prices given. No Government Printing Office publications are sold by the Bureau of Mines. Single copies of reports of investigations and information circulars may be obtained without cost upon request to the Bureau of Mines, Publications Section, 4800 Forbes Street, Pittsburgh 13, Pa., as long as a supply is available.

Handbooks

BUREAU OF MINES. Manual of First-Aid Instruction. 1940, 361 pp. Simplifies descriptions of injuries and their dressings and includes first-aid methods that have been found by everyday application in industry to provide satisfactory care for injuries for which they are recommended. Standardizes first-aid procedure in all industries served by Bureau of Mines for both general first-aid instruction and contest work. Used as text for guidance of Bureau instructors and intended as guide and reference book for miners and others. (Note: A new edition is in course of publication.) $1.00

GROVE, G. W. Self-Contained Oxygen Breathing Apparatus. A Handbook for Miners, 1941, 234 pp. (Revision, in part, of Self-Contained Mine Rescue Oxygen Breathing Apparatus, by D. J. Parker, G. S. McCaa, and E. H. Denny, issued in 1923 and revised in 1929 and 1934.) (Supersedes Tech. Paper 29 and Miners' Circ. 4.) Describes all types of oxygen breathing apparatus approved by the Bureau of Mines; details of design, construction, and testing are confined to those now being used in the United States. Two approved types are manufactured abroad, have not been sold or worn in this country, and therefore are discussed more briefly than those in active service. This handbook covers only briefly the use of oxygen breathing apparatus during rescue and recovery work after mine disasters. (For such information the reader is referred to another Bureau of Mines handbook, Rescue and Recovery Operations in Mines After Fires and Explosions, and Miners' Circ. 36R.) 60 cents

BUREAU OF MINES. Safety Course for Bituminous-Coal Miners. A Handbook for Miners. 1949, 253 pp. Designed to serve as a guide to classes taking Bureau's safety course for coal miners, as well as the information of individual miners, the handbook describes principal hazards of coal mining and methods of dealing with each. 75 cents.

FORBES, J. J., ANKENY, M. J., and FEEHAN, FRANCIS. Coal Miners' Safety Manual. A Handbook for Miners. 1942, 218 pp. Comprises over 800 questions and answers covering all phases of safety in mining. Intended for use of mine operators, rank and file of mine workers, and especially for guidance of men selected to serve on Mine Safety Committees. Answers to questions are based upon good safety practices developed in coal mining and in laboratory research and investigations of Bureau of Mines. 25 cents.

FORBES, J. J., THOMAS, EDWARD, and BARRY, A. J. Questions and Answers on Roof Support in Bituminous-Coal Mines. A Handbook, 1951, 90 pp. This handbook, the second revision of Miners' Circular 31, Questions and Answers on Timbering

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Bituminous-Coal Mines, which was published in January 1928, contains questions and answers on causes of falls of roofs and on roof control in mechanized mining. The first revision was published as Miners' Circular 40, Some Information on Timbering Bituminous-Coal Mines, in May 1939. Since then, numerous changes have been made in mining methods, some additional knowledge has been gained in roof-control methods, and considerable progress has been made by the industry in the design of new types of roof support to meet the specialized needs of coal-mine mechanization. 25 cents.

BUREAU OF MINES. Federal Mine Safety Code for Bituminous-Coal and Lignite Mines of the United States, July 24, 1946. 1946, 84 pp. Covering virtually every phase of operating conditions and practices in coal mines, this code was drawn up by the Bureau of Mines in accordance with the agreement of May 29, 1946, between the Secretary of the Interior, acting as Coal Mines Administrator, and the United Mine Workers of America. Code was placed in effect on July 29, 1946, in all mines in Government possession. 25 cents.

GROVE, G. W. Suggested Procedure for Conducting First-Aid and Mine Rescue Contests, 1944, 92 pp. (Revision of Tech. Paper 579.) Gives practical suggestions for the conduct of first-aid and mine rescue contests. 15 cents.

Pamphlet

BUREAU OF MINES. New Method of Artificial Respiration. 1952, 8 pp. Describes the Holger Nielsen or back-pressure, arm-lift method of manual artificial respiration.

Health and Safety Statistics

BUREAU OF MINES. Haulage Fatalities in Bituminous-Coal Mines, 1951, 1952.

BUREAU OF MINES. Falls of Roof: The No. 1 Killer at Bituminous-Coal Mines, 1952.

BUREAU OF MINES. Fatalities at Pennsylvania Anthracite Mines, 1951, 1952.

Coal-Mine Injuries

BUREAU OF MINES. Coal-Mine Injuries and Employment. Press releases issued monthly.

Coal-Mine Fatalities

BUREAU OF MINES. Coal-Mine Fatalities. Press releases issued monthly.

Bulletin

MOYER, F. T., JONES, G. D., and WRENN, V. E. Injury Experience in Coal Mining, 1948: Detailed analysis of factors influencing mine safety and related employment, production, and productivity data, B 509, 1952, 109 pp. Presents data on fatal and nonfatal injuries in bituminous-coal and Pennsylvania anthracite mines for 1948; historical data on coal-mine fatality rates for the United States during 1870-1948; injury, employment, production, and productivity data by States during 1930-48; and a list of the Nation's major coal-mine disasters and number of men killed from 1910 to 1948. 45 cents.

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Technical Paper

GREENWALD, H. P., HOWARTH, H. C., NAGY, JOHN, and HARTMANN, IRVING. Tests on the Ignition of Natural Gas-Air Mixtures by Permissible Explosives in the Experimental Coal Mine, TP 716, 1949, 38 pp. Describes tests made to determine whether the charge limit for permissible explosives used in coal mines could be increased with safety from 1.5 to 3 pounds per shot hole to facilitate increase in production of coal. Between 1943 and 1947, 654 tests were made in Bureau's Experimental coal mine at Bruceton, Pa., with charges of explosive fires in presence of an explosive mixture of natural gas and air. 15 cents.

Miners' Circulars

STEIDLE, EDWARD. Dangerous and Safe Practices in Bituminous Mines, MC 22, 1919, 110 pp. Includes many illustrations showing good and bad practice in coal mining, and emphasizes the measures that should be taken to increase safety. (Out of print.)

FORBES, J. J., and GROVE, G. W. Mine Gases and Methods for Detecting Them, Revised 1948, MC 33, 1948, 67 pp. First of a series of miners' circulars designed to be used in training that will prepare mine officials to organize men for mine rescue and recovery work. Discusses character and occurrence of mine gases and mixtures of gases. Gives particular attention to flame safety lamps; M. S. A. electrical methane indicators; the hoolamite, colorimetric, and pyrotannic carbon monoxide detectors; and the pyrotannic and M. S. A. indicators. 30 cents.

BERGER, L. B., and SCHRENK, H. H. Sampling and Analysis of Mine Atmospheres, MC 34, 1948, 103 pp. Revision of MC 34, Sampling Mine Gases and Use of the Bureau of Mines Portable Orsat Apparatus in Their Analysis (revised June 1936), by W. P. Yant and L. B. Berger. Second of series of miners' circulars to be used in course of training that will prepare mine officials to organize men for mine rescue and recovery operations. Describes Bureau of Mines methods of sampling mine atmospheres and use of portable Orsat apparatus for analyzing mine atmospheres. 25 cents.

FORBES, J. J., and GROVE, G. W. Protection Against Mine Gases, Revised 1948, MC 35, 1948, 58 pp. Third of series of miners' circulars designed to be used in course of training that will prepare mine officials to organize men for mine rescue and recovery work. Discusses the erection of barricades during mine fires or following mine explosions, the construction of refuge chambers, the carbon monoxide self-rescuer, gas masks, oxygen breathing apparatus, and resuscitation. Its object is to acquaint men thoroughly with the various methods and devices used for protection against mine gases. 20 cents.

FORBES, J. J., and GROVE, G. W. Procedure in Sealing and Unsealing Mine Fires and in Recovery Operations Following Mine Explosions, Revised May 1948, MC 36, 1948, 84 pp. Last of series of four miners' circulars to be used in course of training that will prepare mine officials to organize men for rescue and recovery work. Discusses organization, equipment and materials, and procedure in fighting, sealing, and unsealing mine fires and in recovery operations following explosions. Also includes practice problem for recovery procedure. Although data relate primarily to comparatively thin or medium-thick coal beds with little if any pitch, it is believed that procedure for sealing and unsealing mines, together with principles and technique of identifying fire gases, is applicable, with modifications in some instances, to metal mines and coal beds whether thick or thin and with varying pitches. 30 cents.

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CRAWFORD, F. S., MILLER, A. U., and OWINGS, C. W. Safety Education in Schools of Mining Districts, MC 37, 1938, 34 pp. Stresses importance of safety education in school courses, particularly in mining districts; gives examples of American Automobile Association loose-leaf safety lessons and of National Safety Council plan for primary, intermediate, and upper grades; outlines Bureau of Mines course in first-aid instruction for high-school students and Bethlehem Steel Co. course for seventh- and eighth-grade pupils; and discusses safety instruction in schools and colleges, schoolboy patrols, and school safety organizations, including outline for Minnesota school district. 10 cents.

FORBES, J. J., and OWINGS, C. W. Some Information on Timbering Bituminous-Coal Mines, MC 40, 1939, 37 pp. (Supersedes MC 31.) Greater effort should be made to prevent injuries from falls of roof and coal in mines. Knowledge of what causes roof to fall and of methods to prevent such falls should aid in overcoming this constant hazard. The 154 questions and answers in the circular are supplemented with sketches of mine timbers, principally props, caps, wedges, and cross bars or collars for support of immediate roof in working places, such as in rooms and entries and along lines of pillar extraction. 10 cents.

HARRINGTON, D., and FENE, W. J. Barricading as a Life-Saving Measure Following Mine Fires and Explosions. Revised December 1946, MC 42, 1948, 80 pp. Shows how miners trapped in a mine by an explosion or a fire may escape death by sealing themselves behind well-located and well-constructed barricades, bulkheads, or stoppings. In 1923, MC 25 was issued, giving information on barricading done before that date. 25 cents.

GROVE, G. W., ASH, S. H., and RISTEDT, E. J. Some Haulage Safety Devices for Use on Grades, Slopes, and Inclined Shafts, MC 43, 1942, 44 pp. Discusses and illustrates various safety devices for use on inclines; considers their adaptability with reference to types of inclines. 10 cents.

HOOKER, A. B. Construction, Care, and Use of Permissible Flame Safety Lamps, MC 44, 1944, 18 pp. 10 cents.

BUREAU OF MINES. Accident Statistics as an Aid to Prevention of Accidents in Bituminous-Coal Mines. Coal-Mine Accident-Prevention Course--Section 1. MC 47, 1945, 40 pp. Stressing importance of accurate accident statistics in planning and executing a safety program at a coal mine, this publication is the first in a series designed to help mine officials and supervisors in studying the tools and techniques of accident prevention. It covers methods of computing accident-frequency rates, classification of injuries, facts to be included in accident reports, causes and costs of accidents, and other information. 15 cents.

____. Accidents from Falls of Roof and Coal in Bituminous-Coal Mines. Coal-Mine Accident-Prevention Course--Section 2. MC 48, 1945, 114 pp. Second in series covering various phases of accident prevention in bituminous-coal mines. Directs attention to conditions and circumstances that contribute to accidents from falls of roof in coal mines and suggests practices and regulations to reduce such accidents. 30 cents.

____. Accidents from Hoisting and Haulage in Bituminous-Coal Mines. Coal-Mine Accident-Prevention Course--Section 3. MC 49, 1946, 59 pp. Third in series of miners' circulars forming a text to aid mine operators and officials studying techniques of accident prevention. Advantages and disadvantages of haulage equipment and facilities, transportation hazards, types of transportation,

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maintenance, and education of employees in safe practices are discussed. Numerous publications on hoisting and haulage in bituminous mines are listed as references, as well as other Bureau publications on mine safety. 20 cents.

_____. Explosions and Fires in Bituminous-Coal Mines. Coal-Mine Accident-Prevention Course--Section 4. MC 50, 1946, 107 pp. Fourth in series of miners' circulars covering various phases of accident prevention in bituminous-coal mines designed to aid mine operators and officials in charge of training programs at mines. Lists factors responsible for mine fires and explosions, describes methods for preventing these disasters, and outlines topics for discussion in training classes. Includes illustrations of instruments used for detecting gas and testing velocity of air in a mine, references, and a bibliography. 30 cents.

_____. Explosive Accidents in Bituminous-Coal Mines. Coal-Mine Accident-Prevention Course--Section 5. MC 58, 1947, 82 pp. Fifth in a series of miners' circulars covering various phases of accident prevention at bituminous-coal mines. Describes nonpermissible explosives, permissible explosives, and blasting devices and recommends that permissible explosives be used for blasting coal because they are less liable to ignite the explosive atmospheres that may be found in coal mines. Discusses proper methods of storing, transporting, handling, charging, and firing for the prevention of accidents that may result in personal injuries, loss of life, or damage to property. References on explosives and blasting and Bureau publications on mine safety are included. 25 cents.

_____. Electrical Accidents in Bituminous-Coal Mines. Coal-Mine Accident-Prevention Course--Section 6. MC 59, 1947, 93 pp. Sixth in series of miners' circulars covering various phases of accident prevention at bituminous-coal mines. Discusses surface and underground protection, electrical accidents, and substandard electrical installations. References on prevention of electrical accidents and Bureau publications on mine safety are included. 30 cents.

_____. Miscellaneous Accidents in Bituminous-Coal Mines. Coal-Mine Accident-Prevention Course--Section 7. MC 60, 1947, 85 pp. Seventh in series of miners' circulars intended to comprise a safety course for bituminous-coal miners, especially officials. Sections on surface and underground protection and on health and sanitation are included. 25 cents.

HARRINGTON, D., and EAST, J. H., Jr. Safe Practices in Mine Hoisting. MC 61, 1946, 55 pp. Summarizes safe hoisting practices recognized by the mining industry and suggests a number of safety rules that may be used in connection with hoisting. Safe practices in hoisting from mine shafts and slopes, hoist construction, signaling and proper care, installation and utilization of hoisting conveyances for hoisting and lowering mine personnel are discussed, and latest statistical information on frequency and severity of hoisting accidents in coal and noncoal mines is given. Bibliography included. 15 cents.

Reports of Investigations

NAGY, JOHN, HARTMANN, IRVING, and HOWARTH, H. C. Tests on the Control of Coal-Mine Fires in the Experimental Coal Mine, RI 4685, 1950, 14 pp. Gives results of tests conducted in Experimental coal mine at Bruceton, Pa., to study some of factors that should be considered in fighting mine fires and to obtain data on effectiveness of different types of extinguishing agents.

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HARTMANN, IRVING, NAGY, JOHN, HOWARTH, H. C., and SACHS, ABNER. Recent Rock-Dusting Experiments for Arresting Coal-Mine Explosions, RI 4688, 1950, 16 pp. Describes an investigation in Experimental coal mine at Bruceton, Pa., to determine efficacy and safety of dispersing rock dust by explosives and to ascertain whether explosive gas-air mixtures or coal dust might be ignited during such rock dusting; describes some recent experiments on bag-type devices in which each unit was provided with a burster for scattering rock dust in path of explosion.

JACKSON, E. O., and MERRITTS, W. M. Water Infusion of Coal Pillars Before Mining, Kenilworth Mine, Independent Coal & Coke Co., Kenilworth, Utah, RI 4836, 1952, 25 pp. Dust hazards in a western coal mine were decreased 70 to 90 percent by drilling holes in coal pillars and forcing water through those holes into the cracks and crevices of the bed several days before actual mining was begun. Results of tests of this method of dust control, known as water infusion, conducted in cooperation with Independent Coal & Coke Co., at the Kenilworth mine in Utah, are given.

HARTMANN, IRVING, NAGY, JOHN, and HOWARTH, H. C. Experiments on Multiple Short-Delay Blasting of Coal. In two parts--Part I, RI 4868, 1952, 16 pp. In 1949, a study was undertaken in the Bureau of Mines Experimental coal mine near Pittsburgh, Pa., to investigate the conditions under which simultaneous multiple and short-delay multiple blasting of coal may be used without danger of igniting gas or coal dust in coal mines and to study the vibrations of the mine roof during such blasting. Results of blasting and roof-vibration tests are given. Paper presented at Sixth International Conference of Directors of Safety in Mines Research at the laboratories of the Charbonnages de France, Verneuil (Oise) France, July 24-29, 1950.

HARTMANN, IRVING, NAGY, JOHN, MCGIBBENY, E. B., and CRISTOFEL, F. P. Ignition of Coal Dust by Permissible Explosives, RI 4873, 1952, 18 pp. Results of tests conducted with 14 brands of permissible explosives and with 3 nonpermissibles to study the hazards of coal-dust ignition during blasting in coal mines show that permissible explosives will not ignite coal dust in a mine and cause an explosion when fired in a manner approved by the Bureau of Mines, according to this report describing the tests made. Report to be presented at Seventh International Conference of Directors of Safety in Mines Research at the Safety in Mines Research Establishment, Ministry of Fuel and Power, Buxton, England, July 7-12, 1952.

NAGY, JOHN, HARTMANN, IRVING, CRISTOFEL, F. P., and SEILER, E. C. Experiments on Multiple Short-Delay Blasting of Coal (in two parts). Part II, RI 4875, 1952, 22 pp. Investigation was made to determine the conditions under which short-delay multiple blasting could be used in coal mines without causing ignition of gas, coal dust, or mixtures of gas and dust. Additional aims were to determine the effects of blasting on the mine roof; to find the quantity and breakage of coal produced by multiple blasting; to measure the amount of float dust formed during shooting; and to study the relative time requirement in different blasting procedures. Various recommendations that should help greatly to reduce the incidence of misfires are presented. Paper to be presented at Seventh International Conference of Directors of Safety in Mines Research at the Safety in Mines Research Establishment, Ministry of Fuel and Power, Buxton, England, July 7-12, 1952.

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HARRINGTON, D. What's Wrong with Mine Safety Programs? IC 6958, 1937, 9 pp. Concludes that until management can be induced to assume active responsibility for prevention of mine accidents and to centralize safety problems in one person given executive authority, mine accidents will continue to be a problem. (Out of print.)

_____. Safety Work of the Bureau of Mines and Some of Its Results, IC 7070, 1939, 13 pp. Describes functions, scope, and organization of Health and Safety Branch of Bureau of Mines; reviews its various educational activities (health and safety work and first-aid and mine rescue contests); gives results of Bureau's safety activities in coal mining; and tabulates fatality rates per million tons of coal mined and accident rates in coal and metal mines and quarries of the United States. (Out of print.)

MILLER, A. U. Some Information for Miners About Coal-Mine Ventilation, IC 7137, 1940, 4 pp. Shows importance of adequate ventilation in mine workings; gives requirements of such a system, responsibility for which devolves upon mine operator; and states what mine worker should do to maintain an efficient ventilating system.

_____. How Mine Workers Can Help to Prevent Mine Explosions, IC 7138, 1940, 4 pp. States that mine workers should do their part in demanding and maintaining adequate ventilation, permissible equipment, and adequate rock dusting or other dust-prevention measures. They should also observe all mining laws and company rules.

SLOMAN, H. J. Psychological Aspects of Accident Prevention, IC 7460, 1948, 10 pp. Discusses the value of psychological aids in enlisting the full cooperation of employees in accident prevention.

MCELROY, G. E. Historical Resume of Mine and Tunnel Ventilation Studies, Bureau of Mines, 1910-49, IC 7556, 1950, 16 pp. Summarizes mine and tunnel ventilation studies made by Bureau between 1910 and 1949. Includes bibliography.

WALKER, STANLEY M. Safety Consciousness--an Evaluation, IC 7595, 1951, 8 pp. Report prepared from accident reports studied and observations made during 5 years at the properties of 62 companies in 3 western, 3 eastern, and 4 southern States. Paper presented to the Cement and Quarry Section, National Safety Congress, Chicago, Ill., October 18, 1950.

FORBES, J. J., BACK, T. L., and WEAVER, H. F. Falls of Roof: The No. 1 Killer in Bituminous-Coal Mines, IC 7605, 1951, 11 pp. Human failure caused 89 percent of the roof-fall fatalities that occurred in bituminous-coal mines in the last 10 months in 1950, according to this report based on Bureau investigations of 263 of the 315 fatalities from falls of roof, face, or rib occurring in bituminous-coal mines during the year. The report is arranged to make it as useful as possible to officials of coal companies and mine workers' organizations in planning future accident-prevention programs; to safety instructors, safety directors, inspectors, and supervisors who need data on the specific causes of accidents in order to carry out their duties more effectively; and for discussion at coal-mine safety meetings.

FORBES, J. J., and WEAVER, H. F. Why Men Were Killed at Pennsylvania Anthracite Mines in 1950, IC 7609, 1951, 13 pp. Human failure caused 71 percent of the 76

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fatalities in Pennsylvania anthracite mines investigated by Bureau during last 10 months of 1950. Report describes the accidents in detail and presents suggestions for preventing recurrences.

DAVENPORT, S. J., and MORGIS, G. G. Physiological Aspects of Electrical Accidents in the Coal-Mining Industry, IC 7620, 1951, 19 pp. This circular, describing physiological aspects of electrical accidents in the coal-mining industry, advises applying artificial respiration at once to save the life of one who has been knocked out by an electric shock. Discusses power-frequency currents affecting human beings, physical reaction to various currents, treatment for electric shock, and gives methods for preventing electric shock.

GALLAGHER, F. J. Minimizing Fire Hazards in Coal Mines by Proper Circuit-Breaker Protection of 250/275-Volt Direct-Current Systems, IC 7624, 1952, 11 pp. Some serious fires have occurred in bituminous-coal mines because of short circuits on direct-current power systems that do not have adequate circuit-breaker protection. Results of tests made in four coal mines on the effectiveness of circuit-breaker protection on 250/275-volt direct-current systems are given.

FORBES, J. J., ANKENY, M. J., and WEAVER, H. F. Federal Coal-Mine Inspection--a Decade of Progress. Annual Report for Fiscal Year 1951 and 10-Year Review, IC 7625, 1952, 47 pp. The accomplishments made in the last decade to improve health and safety conditions and practices in the coal-mining industry are presented. During the fiscal year ended June 30, 1951, Federal coal-mine inspectors reported an average of 19 unsafe conditions and practices per mine inspected; 49 percent of the inspection reports issued during the year indicated dangers of a serious nature that were not corrected; and only 27 percent of all the dangers reported by Federal coal-mine inspectors were corrected during the year. More incentives, more safety training, additional technologic improvements, and more adequate mining laws are needed to reduce the incidence of coal-mine accidents further.

ANKENY, M. J. Hazard of Firing Open, Unconfined Shots in Coal Mines, IC 7632, 1952, 4 pp. Describes 6 major explosion disasters that occurred during the past 24 years in coal mines by firing open, unconfined shots and lists precautions for preventing these explosions.

PEARCE, S. J., and BERGER, L. B. List of Respiratory Protective Devices Approved by the Bureau of Mines, IC 7636, 1952, 16 pp. Lists respiratory protective devices approved by the Bureau to June 1, 1952.

KELLY, L. W. Successful Use of Wooden Roof Bolts in Stony Point Mine, Stony Point Coal Co., Hopkins County, Ky., IC 7637, 1952, 4 pp. Purpose of circular is to show that, under the conditions prevailing in the Stony Point mine, wooden bolts were just as satisfactory as steel bolts or conventional timbering, with a reduction of approximately 80 percent in cost of material. Production records have remained constant with both wooden and steel roof bolts.

KINGERY, D. S. Recommendations for Improved Shuttle-Car Haulage Safety, IC 7638, 1952, 10 pp. Gives recommendations that will help coal-mine safety engineers, mine managers, safety committeemen, and supervisory officials in their efforts to prevent shuttle-car accidents at bituminous-coal mines.

KINGERY, D. S., and BAKER, F. D. A Practical Method for Teaching Mine Workers and Officials Use of Gas-Detecting Equipment, IC 7639, 1952, 6 pp. A practical and simple method of training men to detect coal-mine gases has been developed by

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the Bureau, according to this circular describing an experimental training course conducted by the Bureau. The training course was complete with lectures, demonstrations, and practical work and was concluded with an examination showing each trainee's progress.

HANNA, N. E., and DAMON, G. H. Active List of Permissible Explosives and Blasting Devices Approved Before December 31, 1951, IC 7640, 1952, 12 pp. Contains a complete active list of permissible explosives (gelatinous and non-gelatinous) and permissible blasting devices approved to December 31, 1951.

ANKENY, M. J., WESTFIELD, JAMES, and KINGERY, D. S. Ventilating Practices That Minimize Explosion Hazards in Bituminous-Coal Mines, IC 7648, 1952, 6 pp. Recommends ventilating and electrical practices for reducing explosion hazards in coal mines from accumulations of methane and presents ventilation and electrical plans that illustrate some mining methods and ventilation practices in the bituminous-coal-mining industry.

KELLY, L. W. Economies Through Roof-Bolting in an Indiana Coal Mine, IC 7653, 1952, 10 pp. Describes how $63,221.17 was saved by roof bolting the main west entry of the Kings mine in Indiana instead of using the peg-timbering method.

Careful examination of the Bureau of Mines catalogues of publications3/ may reveal many other publications pertinent to a specific educational program.

Demonstrations

Large-scale explosion demonstrations are conducted periodically at the Bureau's Experimental mine at Bruceton, Pa.

Demonstration units are used extensively, and their effectiveness depends on the instructor's ability to use the units and make proper explanations so that the persons attending classes leave with a lasting impression. Three such units are:

1. Arcs and Sparks Demonstration (Igniting Gas-Air Mixtures)

2. Explosibility of Coal and Other Dusts

3. Magic of Fire

The following publications and instructions were prepared for the guidance of demonstrators:

Instructions for Operating Arcs and Sparks Ignition Gallery

Small Portable Coal-Dust Explosion Gallery (IC 7520)

Procedure in the Use of Small Dust Gallery

Fire and Explosion Lecture Demonstration (Magic of Fire)

Demonstrations of Explosions (Bruceton, Pa.)

3/ Bureau of Mines, Publications of the Bureau of Mines, July 1, 1910-January 1, 1949. 1950, 460 pp. $2.00. (Annual supplements have been issued for the calendar years 1949, 1950, and 1951.)

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Safety-Training Courses

In addition to accident-prevention instruction, Bureau members conduct classes in mine rescue and recovery operations, use of respiratory equipment, and first aid. They also conduct and judge contests designed to stimulate interest in the study of first aid and mine rescue and teach others to carry on this activity.

Certificates and pocket cards are issued to those completing the various courses. These contribute much to the program, as the miners value them highly and often carry the pocket cards on their persons for many years.

A brief summary of the certified training programs follows.

Course	Number trained
July 1, 1910-June 30, 1952	
First aid	1,153,384
Mine rescue	76,946
First-aid letter certificates (coal and others)1/	1,565
Mine rescue letter certificates (coal and others)1/	562
July 1, 1931-June 30, 1952	
First-aid instructors (coal and others)	19,021
July 1, 1939-June 30, 1952	
Mine rescue instructors (coal and others)	215
July 1, 1926-June 30, 1952	
Advanced mine rescue (coal and others)	4,268
July 1, 1938-June 30, 1952	
First-aid judges' course (coal and others)	1,557
July 1, 1931-June 30, 1952	
Coal-mine accident-prevention course for supervisors	24,189
July 1, 1939-June 30, 1952	
Coal-mine accident-prevention course for miners	63,197
	Certificates issued
July 1, 1928-June 30, 1952	
100-percent training in first aid	3,324
July 1, 1949-June 30, 1952	
100-percent training in coal-mine accident-prevention course for supervisors	107
July 1, 1949-June 30, 1952	
100-percent training in coal-mine accident-prevention course for miners	139

1/ Issued to children under 16 years of age and to persons not engaged in the mineral industries.

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Arrangements for classes vary in many ways. In some instances, the operating company sponsors the program, whereas in others classes are arranged with the aid of the mine workers' union officials. It is often necessary for the instructor to combine the efforts of the operators and the union leaders. At times, a personal canvass of the employees at a mine must be made and each individual worker contacted and convinced that he will benefit from the safety program.

STATE MINING DEPARTMENTS

Coal mining is governed by laws in most coal-producing States. Such laws are published and available to all workmen. In many States certificates of competency are required for such positions as shot firer, miner, machine runner, fireboss (mine examiner), and foreman. It is therefore necessary for those aspiring to such positions to prepare in order to pass the required examinations. In Pennsylvania both anthracite and bituminous coal are mined, and separate sets of laws are in force.

Many State mine-inspection agencies employ instructors in first aid and mine rescue and conduct training and contest work. Some of the States also conduct general safety training. The following is quoted from a letter written recently by Joseph Bierer, acting chief of the West Virginia Department of Mines:

> Our training program for mine workmen is based on five (5) service trucks, that are stationed in separate divisions of the State. Each of these trucks is staffed by one man that is titled safety instructor-driver, under the direction of our assistant safety director.
>
> Arrangements are made with employers to have workmen in a particular type of work report at a designated place for class instructions. The class is given two hours instruction in particular hazards incident to their work and ways of preventing accidents. Each class member is presented a booklet treating with particular accidents and statistics on their particular work.
>
> The booklet mentioned above has been prepared by our Accident Prevention Commission, composed of three men with long and wide experience in mining.
>
> At present each class treats with one of three subjects: haulage, machine men, and coal loaders. Each two-hour session completes a particular subject and certificates are awarded.

The following is quoted from a letter recently written by A. D. Sisk, chief of the Department of Mines and Minerals of Kentucky:

> We do not publish booklets on the training done by the personnel of the Kentucky Department of Mines and Minerals. However, briefly, here is what we do:
>
> 1. From time to time our inspectors conduct classes in practical coal mining to assist workers in preparing to take the State mine foreman's examination.
>
> 2. Our inspectors train miners in mine rescue and recovery procedures.
>
> 3. The personnel of this department are qualified to act as judges in first aid and mine rescue contests, and very often do.

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4. Various persons in the Department of Mines and Minerals attend the various safety meetings for the purpose of making addresses.

5. Various personnel of the department attend Institute meetings and often enter into the discussions of current topics.

6. Personnel of the department conduct, each year, a class in first aid and mine rescue procedures at the University of Kentucky.

The Industrial Commission of Ohio, Division of Safety and Hygiene, from time to time issues posters for display at coal mines. These posters are effective in creating safety interest.

No attempt was made to secure a copy of the laws in force in each coal-producing State. However, these may be obtained from the agency controlling and supervising mining in the State.

PROGRAMS CONDUCTED BY INDIVIDUAL MINE OPERATORS

In many instances the operators of coal mines employ a safety director and sustain a safety program. Safety rules and regulations are published and distributed to employees. New employees are indoctrinated carefully, and care is taken that they learn their job properly. Some of the rule books contain a page to be signed by the employee stating that he will become familiar with the rules and comply.

Training in first aid and mine rescue is given in many instances by the operating company, utilizing assistance from the Federal Bureau of Mines and State mining departments.

First-aid teams are trained and equipped for contest work, and in some instances safety awards are given.

The operating companies respond very well to requests for cooperation in the Bureau of Mines accident-prevention programs. They encourage their workmen to attend, provide meeting rooms, give dinners at the completion of class work, and often give prizes and souvenirs to those completing. Often the operating-company officials do all the work necessary for the organization of classes and then ask the Bureau of Mines for an instructor to conduct the training.

Some mine operators extend their safety program to include first-aid training for the miners' wives and children. One such operator trained 336 young men and women under 16 years of age during the period from July 1, 1951, to June 30, 1952, in Pennsylvania and West Virginia.

PROGRAMS CONDUCTED BY MINE WORKERS' ORGANIZATIONS

The United Mine Workers of America maintains safety organizations at national and local levels. A safety organization, operating nationally, is headquartered in Washington, D. C. Some of the districts that form the area government of the union maintain safety directors. Each local union maintains a safety committee at every mine at which it operates. This committee functions under the provisions of a contract between the company and the union organization.

The mine workers' union organizations are placing more emphasis on safety education than ever before. Workers are encouraged by their union leaders to take

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part in the safety educational program. These leaders make personal contact with the mine workers, letters are sent out to each local union, and every other means possible is used to encourage first-aid, mine rescue, and other safety educational programs.

In many instances the program is undertaken entirely by the union, which provides the meeting rooms and whatever services are necessary to make these meeting rooms comfortable, then asks the Bureau of Mines to provide instruction personnel. Some of the unions' district officials issue pocket cards to those completing the training course. The national mine workers' organization awards a large certificate to those local unions wherein all the members complete the accident-prevention course.

The mine workers' organizations encourage participation by their members in first-aid and mine rescue contests. Mine workers are also urged by their leaders to attend the large-scale demonstrations conducted by the Bureau of Mines at the Experimental coal mine at Bruceton, Pa. Union leaders are always available as speakers on these occasions.

INSTITUTES, SOCIETIES, AND OTHER EDUCATIONAL ORGANIZATIONS

Many such organizations flourish in the United States, some on a national level and others at the local level. In the main, the majority of the organization activities are directed at the supervisory, operator, or engineer level. However, many of the organizations are open to membership by the mine workers, who are permitted to participate in the activities of these educational organizations, and a large number of them do so.

The discussions conducted by such organizations are used in the safety programs throughout the industry and form part of the basis on which instruction is given. Some of the organizations publish the papers presented at their meetings. A few of the organizations are listed below with a brief summary of their purpose and activities.

The Joseph A. Holmes Safety Association

Founded in 1916 by 24 leading national organizations representing the mining, metallurgical, and allied industries to commemorate the efforts of Dr. Joseph A. Holmes, the first Director of the Bureau of Mines.

The purpose of the organization is twofold:

(1) Making one or more annual awards, with or without honorariums, to be known as Holmes Safety Awards, for the encouragement of those originating, developing, and installing the most efficient safety devices, appliances, or methods in the mining, quarrying, metallurgical, and mineral industries previous to the close of the preceding calendar year.

(2) Awarding suitable medals, from time to time, for personal heroism or distinguished service in the saving of life in any branch of the mining, quarrying, metallurgical, and mineral industries.

References: Harrington, D., Pedlow, Louise, and Brown, Anna P. The Joseph A. Holmes Safety Association and Its Awards, Bureau of Mines Bull. 421, 1940, 121 pp. Reviews history, organization, and purpose of Joseph A. Holmes Safety Association and lists companies, mines, and individuals, alphabetically and numerically, that

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have received hero and safety awards from 1919 to 1938. Numerical lists include statements that appeared on certificates accompanying hero awards and on certificates for safety achievements. Records show definitely that safety is attainable in almost every branch of mineral industries. 20 cents.

Harrington, D. The Joseph A. Holmes Safety Association and Its Awards. Bureau of Mines Inf. Circ. 6831, 1935, 100 pp. Reviews history of organization of Joseph A. Holmes Safety Association, and prints all citations that have accompanied rewards bestowed to date. (Out of print.)

Holmes Safety Association

Organized in 1926 with a fivefold objective:

(1) Prevention of fatalities and injuries and improvement of health conditions of all persons connected with the mining and allied industries.

(2) Dissemination of information and instruction on subjects related to the promotion of health and safety in mining and allied industries.

(3) Promotion of training in first aid, oxygen breathing apparatus, and other forms of protection in mine rescue and recovery operations.

(4) Close cooperation with other safety agencies.

(5) Promotion of educational, social, and recreational activities.

The association is composed of district councils and local chapters that meet monthly and a national organization that meets annually. The local organizations discuss safety subjects, issue accident statistics, etc., and the national organization directs the work on a national scale.

Many mine workers join their supervisors and leaders in the work of the Holmes Safety Association. Bureau of Mines personnel are very active in this organization and supply much of the needed information and leadership.

References: Holmes Safety Association - Handbook.
Holmes Safety Association Monthly Council Report.
Holmes Safety Association Annual Report.

National Mine Rescue Association

Founded in 1924, this organization has done much to decrease the number of mine fires and explosions in the mining industry. Training in mine rescue and recovery is encouraged, and the membership consists of mine workers as well as mine officials and Federal and State inspectors. This organization meets once each year. Mine fires and explosions that occurred during the year are discussed, and ways and means to prevent similar occurrences are presented. Those that have by long service and experience distinguished themselves are designated as mine rescue veterans.

Since the coal fields of the United States are extensive, branches of the organization , known as Posts, have been established in several of the large coal-producing States to permit broader participation at the local level. The main Post is at Pittsburgh, Pa., and additional Posts have been established at Barbourville, Ky., Mt. Hope and Montgomery, W. Va., and Benton, Ill.

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The Mining Electro-Mechanical Maintenance Association

This association, operating in the tri-State area (Pennsylvania, Ohio, and West Virginia), has 8 branches with over 1,000 members. Most of the members are working mine electricians and mechanics. They meet at regular intervals to discuss mutual problems and to take part in educational programs in the safe practices pertinent to their jobs. Similar organizations function in other parts of the United States.

Publications of this association include the following:

Mining Electro-Mechanical Maintenance Association -
The Development and Growth of an Idea

Mining Electro-Mechanical Maintenance Association -
Suggestions for Developing Programs

Mining Electro-Mechanical Maintenance Association -
Membership Card

Mining Electro-Mechanical Maintenance Association -
Constitution and By-Laws

National Safety Council

The National Safety Council is well known throughout the world, and it is not necessary at this time to discuss its activities. Very few mine workers take a direct part in the functions of this council; however, the results of council activities do reach the mine worker by way of his supervisor and safety instructor.

Meetings are held where safety is discussed, and reports are published.

The National Safety News, a periodical publication, is read by many mine workers.

American Mining Congress

Participation by mine workers in this organization is limited; however, it is another instance whereby, through meetings and publications, such as the Mining Congress Journal, the benefits derived from the research and development are brought to the individual mine worker.

Conferences are held and matters pertinent to the industry are discussed.

The annual meeting and the Coal Show, a display of newly developed machines, add much to the educational programs of all concerned. The mine owners, officials, workmen, and union officials visit the Coal Show and participate actively in the program.

American Institute of Mining and Metallurgical Engineers

International in its scope, this institute does much to contribute leadership to the mining industry. Very few miners ever join this institute as members, but the work of the institute bears directly on the safety and comfort of each mine worker. The publications of this institute have a far-reaching effect on the welfare of the mining industry.

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Coal Mining Institute of America

Since 1887 this institute has fostered this objective: The increase and diffusion of knowledge pertaining to coal mining. Membership is open to all who are connected in any waywith coal mining. An institute meeting is held once a year wherein problems pertaining to mining and mine safety are discussed. The papers read during the institute meeting and the discussions that follow are published and add much to the material available for use in safety instruction.

Pittsburgh Coal Mining Institute

This is a local-level institute that gives mine workers, their supervisors, and employers in the Pittsburgh area an opportunity to meet and discuss mutual problems. Many such institutes hold meetings throughout coal-mining areas and add much to the safety programs in progress. These institutes foster and encourage first-aid and mine rescue training, as well as safety education in general.

Mine Inspectors' Institute of America

Membership is limited to coal-mine inspectors, Federal, State, and private.

An institute meeting is held each year, and ways and means to promote safety in coal mining are presented and discussed. The proceedings of this institute meeting are published, and the results benefit all mine workmen. This institute tends to bring about uniformity in inspection procedure and make the knowledge gained by experience in the various coal-producing areas available.

National Coal Association

The National Coal Association encourages education in coal mining. The scope of their program is expressed in a letter written recently by M. D. Cooper, Director of Mining Engineering Education, National Coal Association, Southern Building, Washington 5, D. C.:

> In general, the training of young men below college level is not as thorough in the United States as it is in European countries. On the college level, I believe that the training of mining engineers is equal to similar training anywhere. Some of the companies have training courses for new employees. Island Creek Coal Company is perhaps the leader in that respect. Rochester & Pittsburgh Coal Company also has a well-supervised course in charge of ------.
>
> The publications being sent to you are largely for the purpose of bringing accurate information to students, helping them to select proper courses in high school to prepare them for work in the industry or for admission to college to study mining engineering.
>
> An important part of the work for our Committee is to visit the colleges teaching mining engineering and report on those visits so that the members of the National Coal Association and others may obtain some direct information in regard to the courses offered at the respective institutions.
>
> Cooper will furnish the following information on request:
>
> Map of Coal Areas in the United States
> A Message to Young Men Who Plan to Enter Coal Mining

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What is the Right Job for Me?
Report of Vocational Training and Education Committee
Visit to Colorado School of Mines
The Problem of Properly Trained Technical Personnel

UNIVERSITIES, COLLEGES, AND HIGH SCHOOLS

In addition to their regular programs, some American universities and colleges conduct educational programs by mail and give extension services, such as classes in local communities, wherein mining and mining safety are taught. Mine workers are prepared for the examinations that must be taken to get positions requiring certification. Many of these institutions are very actively engaged in programs of this type with gratifying results.

In addition, some high schools in coal-mining areas conduct courses in fundamental coal-mining subjects as elective subjects along with their regular curriculum.

CONCLUSIONS

The greatest contribution a man can make to the society that fosters him is to do something that will help someone else save or prolong his life and usefulness.

The purpose of this publication will be achieved when better understanding of coal miners, their work, and their safety is reached.

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